

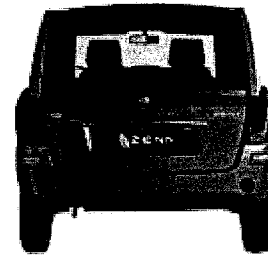


# Electric-Cars-Are-For-Girls.Com

## Electric Car Safety

**Are you safer out there on the road in a Hummer, or a ZENN?**

Recently I got an email from a guy named Joe down in California. He was one of the first people in the Santa Cruz area to get a new ZENN, a small and luxurious neighborhood electric vehicle made in Canada. You can legally drive them on roads posted at no more than 35mph in most states, although the car's maximum legal speed is 25mph.



I LOVE my new Zenn, he said. The gas-gulper's been growing a coat of dust in the garage since I brought it home. **Only trouble is, last week some dude in a Sequoia came across the intersection and T-BONED us.**

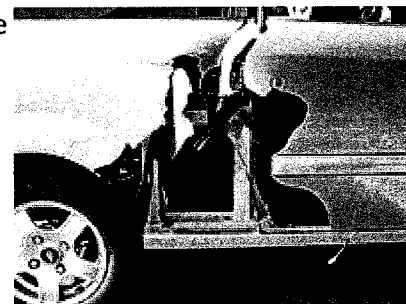


Nobody got hurt, he said.

My girlfriend's got a little bruise on her arm and a sore back, but she'll live. The ZENN's a little torn up, though. There I was at the intersection, and the guy in the Sequoia just floored it taking off from a stop. **He must have been going 20-25mph by the time he got over and slammed into us.**

**We were knocked sideways 10-15 ft.** The Zenn skidded, but was easy to get back under control, and at no time did it feel like it was going to roll over.

The side and rear panels were trashed, but **the impact bar seems to have held up just fine.**

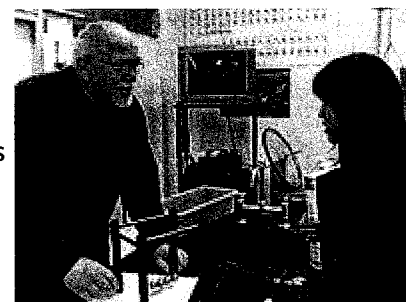


## What Physics?

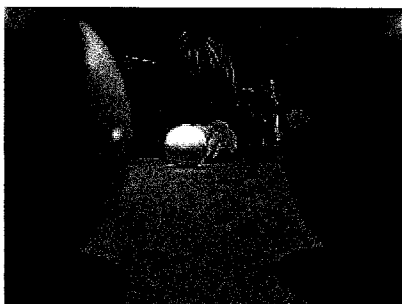
I took Joe's email to **Bill Green, who teaches physics at the high school** down the street.

What's going on, I asked, when a big car hits a small car?

Well, he says, **the momentum** - which is the weight of the car times its speed - **is transferred from the big car to the small**



**car.** Also, the momentum of the small car is transferred to the big one. Assuming that the impact is just "boom", then it's over, you can think of the momentum as the force applied to the other car. See?



No, I mean, what HAPPENS?

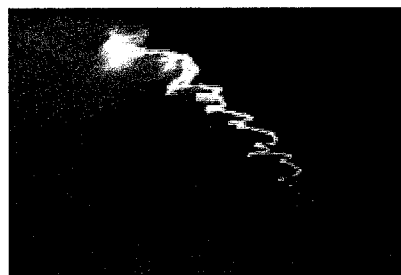
**The big car will come to a stop, probably, and the little car will bounce.** Probably.

And by "bounce" you mean...

**I mean it becomes a lil missile,** he says happily. Ever play billiards?

I think about my four inebriated attempts to whack pool balls into pockets at the local bar, and nod. **I'm a little alarmed by the image of a ZENN-missile.**

So, he says, it's the same thing. **The cue ball weighs more than the ones with the little numbers on them,** so there's your Sequoia coming across the intersection with some velocity.



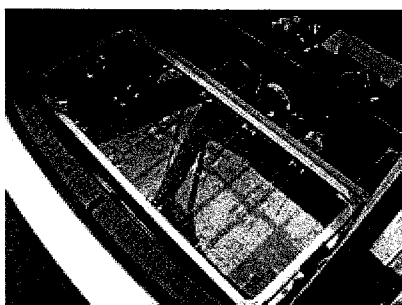
Your ZENN goes ricocheting off, and the Sequoia comes to a stop.

That's because the ZENN doesn't contribute much return force to the Sequoia, being a fifth of its weight and having no speed at all.

## **Batteries in the floor keep the rubber side DOWN.**

Unlike the billiard ball, though, he continues, **your little ZENN doesn't like to roll over.** Can you see why?

I feel like one of his students. Because of all the batteries in the floor? I reply hesitantly.



He smiles and nods. (I'd forgotten just how gratifying it is to have a teacher smile and nod when you answer a question.) **Most of the car's weight is down under the floor,** and that means them lil feet are just glued to the floor. Good news for you, since **a lot of car fatalities happen when the rubber side doesn't stay down.**

Then, because it's a light little car - what, a half-ton or something like that, despite the big load of batteries? - it skids a little, that's static friction, by the way...

...and then the brakes take over, that's rotational friction, and you easily get control of the car again. **Light cars stop quicker than heavy ones, generally.**



## But what about ME??

What happens to **my fragile human body inside the ZENN** during all this momentum exchange, bounce, and friction?

**Inertia**, he says. You wanna get you some really, **really good seat belts**.

I think of the race car drivers with their roll cages and three point restraints. They probably know all there is to know about high speed/low mass collisions. **Bet they wish they had a quarter-ton of batteries gluing THEIR car's feet the the floor.**

## Rubber bumpers...



So...can you explain why people seem to get hurt in car crashes even when they're not going very fast, but **you can get into bumper cars at the fair and bang into each other all day long** without going to the chiropractor?

One factor, of course, is that **the bumper car is very light**. Remember the momentum equation? But that's not the whole story. **They're also wrapped in rubber, which helps to absorb that impact.** Some cars have springs in the bumpers now for the same reason, and it's a good idea.

Doesn't help if you get t-boned, though.

There's some legislation being considered right now in Washington and California on raising the legal speed limit of neighborhood electric vehicles from 25mph to 35mph, I say. Good thing or bad thing?



At those speeds, he replies, **the question is really less about the speed of your little ZENN than it is about the speed and weight of the Hummer that runs into you.** Your ZENN's little momentum equation is not adding that much to that picture either way. But again, any investment you make in really good safety equipment will really pay off.

## So am I safer in a Hummer, or not?

Are you telling me the car dealer is right, then - you're safer out there on the road with a Hummer? I ask. It's hard for me to believe that a BIG crash is better than a LITTLE crash.

No, I don't mean to say that, he says. **I mean we're all safer out there with NO Hummers on the road.**

It's like arms escalation, isn't it? Driving a bigger tank doesn't really keep you safe...it just keeps us all UNSafe.

Meanwhile, don't worry too much about getting run over - you're quick and nimble in your NEV, better for not getting into accidents in the first place; **and don't forget, you'll BOUNCE!**